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Title: Foamed Vehicle Part and Method of Manufacturing

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SUBMISSION OF CERTIFIED TRANSLATION OF PRIORITY DOCUMENT

Dear Sir:

Applicant is hereby submitting a certified translation of German Patent 103 08 582.3 to which priority is claimed in the subject application.

Favorable consideration if requested.

Respectfully submitted,
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Dated: November 14, 2005

CERTIFICATE OF MAIL

I hereby certify that the enclosed Response is being deposited with the United States Postal Service as First Class Mail, postage prepaid, in an envelope addressed to Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on this 14 day of November, 2005.

Laura Combs

Certified Translation

FEDERAL REPUBLIC OF GERMANY

(coat of arms)

Certificate of Priority Relating to the Filing of a Patent Application

Serial Number:	103 08 582.3
Filing Date:	27 February 2003
Applicant/Owner:	ArvinMeritor GmbH, Dietzenbach/Germany
Title:	Method for Manufacturing a Vehicle Body Part
IPC:	B 29 C, B 62 D

The attached documents are a correct and true copy of the original documents of this patent application.

Munich, dated 7 November 2003
German Patent and Trademark Office
The President
By:

[seal of the German Patent and Trademark Office]

(signature)

Schmidt C.

CERTIFICATE

I, Thomas Kitzhofer, of Manzingerweg 7, 81241 München, Germany, declare that I am conversant with the German and English languages, and that to the best of my knowledge and belief the accompanying text is a true translation of the priority document issued by the German Patent and Trademark Office on 7 November 2003, for Serial No. 103 08 582.3.

Signed this 31st day of October 2005

PRINZ & PARTNER GbR

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Method for Manufacturing a Vehicle Body Part

The present invention relates to a method for manufacturing a vehicle body part, in particular a vehicle roof module.

Vehicle body parts are increasingly manufactured at the suppliers and are mounted on the body frame at the vehicle manufacturer. Vehicle body parts are manufactured in sandwich manner, they are light and yet very stable, and they usually have a thin deep-drawn exterior covering made of plastic or aluminum. Great demands with respect to surface qualities are placed on the visible side of the exterior covering in the installed state of the body part. The goal is to achieve a so-called class-A surface, which is extremely smooth.

However, this surface quality is very difficult to achieve for the following reasons. The film-like exterior covering is usually foam-backed. The foam then forms a so-called support layer. This layer, however, is provided with a plurality of webs or, in general terms, agglomerations of mass. Foam shrinks when it hardens, so there is greater shrinkage in an area having greater thickness than in areas having less thickness. For this reason, the result is so-called indentations or "valleys" in the film, which of course is quite thin and has little stability of its own. These indentations can be visible from outside and can reduce the quality of the surface. Another problem can arise if fibers, usually glass fibers, are embedded in the foam. This occurs during the application of the liquid plastic,

before the foaming process. This process is also termed LFI (Long-Fiber-Injection method). After the hardening, the fibers can leave their imprint on the exterior surface of the covering if they are disposed directly on the reverse side of the covering and if, in addition, the cut edge of the fibers ends up being perpendicular to the exterior covering. This imprinting occurs due to the fact that the fibers result in very small, elevated locations arising on the exterior side of the covering.

The present invention provides a very simple method for manufacturing a vehicle body part, using which they can be manufactured in a very cost-effective manner and at the same time have an excellent exterior surface.

This is achieved as a result of the following steps, that are to be carried out in sequence:

a) on the reverse side of a deep-drawn, film-like exterior covering, a thin film made of liquid, hardening plastic is directly applied,

b) the plastic material is hardened without foaming, and

c) the sprayed exterior covering is foam-backed on the reverse side.

The liquid plastic material, which, for example, can be polyester resin or polyurethane, after hardening becomes a hard, thin film, which presents a plurality of advantages. For one, it stabilizes the exterior covering and prevents indentations from occurring due to the varying thicknesses of the foam layers and from becoming visible on the exterior covering, and for another, it prevents fibers from imprinting themselves on the exterior side after the foam-backing process. A further advantage lies in the fact that the film-like exterior covering no longer needs to be seared on the reverse side, as is necessary in the related art, in order to make the exterior covering "reactive" for the later applications of polyurethane foam and to achieve a bond between the exterior covering and the foam layer. Searing of this type can be completely dispensed with. A further advantage lies in the fact that it is possible to achieve a foam layer that is generated by the foam-backing process and that has markedly varying thicknesses, and all in one working

operation. It has hitherto been thought to initially produce a first foam layer of uniform thickness, which so stabilizes the intermediate product made of the exterior covering and the foam layer that a further foam layer having segments of markedly varying thicknesses can be manufactured that then no longer generates the indentations. However, this method requires the use of two different foam dies, for producing the first foam layer and for producing the second foam layer. Using the method according to the present invention, it is possible using one die to manufacture a vehicle body part which has a foam layer that has segments of markedly different thicknesses.

According to the preferred embodiment, the hardness of the hardened film should be greater than that of the hardened foam. In addition, the film should have a thickness of roughly 0.1 to 0.8 mm.

As already mentioned above, it may be advantageous to reinforce the foam with fibers in the LFI method, as a result of which a very sturdy vehicle body part can be manufactured.

As likewise mentioned above, the exterior covering is made up of a thin plastic or aluminum deep-drawn film that is roughly 0.5 to 1.5 mm thick.

The film can be sprayed on the reverse side, outside of the foam die or, depending on the hardening time, within the foam die, where it is subsequently backed with foam.

The film is made of a thermosetting plastic material, preferably polyester resin or polyurethane, this material being applied not as foam but rather reinforcing the exterior covering on the reverse side as a thin, very dense, and hard film.

During the foam-backing process, the liquid plastic, usually polyurethane material, can either be applied directly onto the hardened film, or after step b) a glass fiber matte can be placed onto the exterior covering and the film. Only then is the exterior covering foam-backed, the polyurethane material penetrating the fiberglass matte and binding itself to the film.

Using the method according to the present invention, it is also very easy to embed inserts in the body part using the foam. Inserts of this type are, for example, hollow bodies which form the interior of webs, tubes, or attachment parts which partially protrude from the foam and by which the body part is secured to the vehicle. It is also conceivable to attach sun visors, grab handles, or other component parts to these attachment parts. These inserts are inserted into the foam die before the foam-backing process. Subsequently, they are embedded in the foam, thus constituting a component of the body part.

As mentioned, the method according to the present invention is carried out such that only one foam layer is created as a result of the foam-backing process.

Further features and advantages of the present invention will become apparent from the following description and from the following drawings, to which reference is made. In the drawings:

- Figure 1 depicts a vehicle body part manufactured using the method according to the present invention, in the form of a vehicle roof module,

- Figure 2 depicts a partial cutaway section of the vehicle roof module in Figure 1, from which its construction is visible,

- Figures 3 through 5 depict sequential steps in the manufacturing method of the vehicle body part according to the present invention.

In Figure 1, a vehicle is depicted whose roof is supplied as a separately manufactured vehicle body part in the form of a roof module and is attached to the body frame. Vehicle roof module 10 has an exterior covering 12 having a class-A exterior surface.

As Figure 2 shows, the vehicle roof module has a sandwich-like design. Visible from the outside in the installed state is exterior covering 14, which is made up of a painted plastic or aluminum film, which is shaped by deep drawing. The thickness of the film-like exterior covering is between 0.5 and just under 1.5 mm. On the rear side, directly on exterior covering 14, a film is applied that is a

maximum of roughly 0.8 mm thick and is made of relatively hard, non-foamed plastic, preferably polyester resin or polyurethane, which bonds to exterior covering 14. The film bears reference numeral 16. Applied to the reverse side of the film is a foam layer 18 made of polyurethane material. Foam layer 18 is the only layer of the vehicle roof module that is generated using the foam-backing process along with exterior covering 14 and film 16. Foam layer 18 has segments of varying thicknesses, the thinnest segment having a thickness d1 that is less than half as thick as the thickest segment having thickness d2.

Various inserts 20, 22, are embedded in foam layer 18, namely a hose-like hollow body 20 along a raised section 24, and attachment elements having threaded bolts protruding from foam layer 18 along an edge section 26.

The manufacturing method for vehicle roof module 10 is explained below.

Exterior covering 14 is permanently shaped through deep drawing, it being optionally possible to carry out this step in lower mold half 32 of a foam die 30, that is made up of a lower mold half 32 and an upper mold half 34 (see Figures 3 through 5). The exterior covering, as already mentioned, is made of plastic or aluminum, the plastic films advantageously being through-painted, thus making an exterior enameling unnecessary, and the exterior covering made of aluminum is furnished with a very thin, through-painted plastic layer.

On the reverse side of exterior covering 14 using a path-controlled spray head 40, a liquid plastic is spray-applied to form a thin film 16 made of this plastic, which completely covers the reverse side of exterior covering 14. Film 16 is made of polyester resin or polyurethane material and after hardening, which takes place without foaming, has a hardness that significantly exceeds the hardness and the density of foam layer 18, which is applied later.

This application of the thin, subsequently hardened film made of plastic can be accomplished in a foam die, as depicted in Figure 3, but it can also be carried out outside of same. It is important that the reverse side of the exterior covering 14 no

longer requires searing, because the covering is sprayed without any prior treatment, as Figure 3 shows.

Subsequently, a fiberglass matte 50 is optionally applied directly onto film 16. In addition, inserts 20, 22, if used, can optionally be positioned in the die. These steps of inserting fiberglass matte 50 and inserts 20, 22, are optional, as was said.

However, in any case, after exterior covering 14 is inserted into lower part 32 of die 30 and is provided with film 16, liquid polyurethane material 60 is subsequently applied using a remote-controlled nozzle tip 70. During application, glass fibers are added to the liquid polyurethane material 60, which mix uniformly with the material (LFI method). This is shown in Figure 4.

After the complete application of liquid polyurethane material 60, the die is closed by attaching upper mold half 34, the die is heated so that polyurethane material 60 foams, and foam layer 18 is created (Figure 5).

Inserts 20, 22, are omitted from Figure 5 only in order to simplify the presentation.

Claims

1. A method for manufacturing a vehicle body part, in particular a vehicle roof module, characterized by the following steps, that are to be carried out sequentially:

a) a thin film (16) made of liquid plastic is directly applied onto the reverse side of a deep-drawn, film-like exterior covering (14),

b) the plastic is hardened,

c) the exterior covering (14) that is provided with the film (16) is foam-backed on the reverse side.

2. The method as recited in Claim 1, characterized in that the film (16) is applied by spraying.

3. The method as recited in Claim 1 or 2, characterized in that the hardness of the hardened film (16) is greater than that of the hardened foam layer (18).

4. The method as recited in any of the preceding claims, characterized in that the foam layer (18) during its manufacture using the LFI method is reinforced with fibers.

5. The method as recited in any of the preceding claims, characterized in that the exterior covering (14) is a plastic or aluminum film.

6. The method as recited in any of the preceding claims, characterized in that the exterior covering (14) is sprayed in an open foam die (30) and is then foam-backed therein.

7. The method as recited in any of the preceding claims, characterized in that the film is made of a thermosetting material, in particular polyester resin or polyurethane.

8. The method as recited in any of the preceding claims, characterized in that during the foam-backing process, liquid plastic is applied directly onto the hardened film (16).

9. The method as recited in any of Claims 1 through 8, characterized in that after step b) a fiberglass matte (50) is placed on the reverse side of the exterior covering (60) and then is foam-backed.

10. The method as recited in any of the preceding claims, characterized in that the foam layer (18) that is manufactured by the foam-backing process has varying thicknesses (d1, d2).

11. The method as recited in Claim 10, characterized in that in the foam layer (18) differences in thickness occur of at least a factor of two.

12. The method as recited in any of the preceding claims, characterized in that, before the foam-backing process, prefabricated inserts (20, 22) are placed into the foam die (30) and then are embedded in foam in order to form a part of the vehicle body part.

13. The method as recited in any of the preceding claims, characterized in that only a foam layer (18) that is produced by the foam-backing process is created.

Abstract

Method for Manufacturing a Vehicle Body Part

A method for manufacturing a vehicle body part proposes that a thin film (16) made of liquid plastic is applied to a deep-drawn, film-like exterior covering (14), the film after hardening preventing indentations due to varying levels of shrinkage from becoming visible on the exterior covering (14) during the subsequent foam-backing process, as a result of having segments in the foam of varying thicknesses.

Figure 2

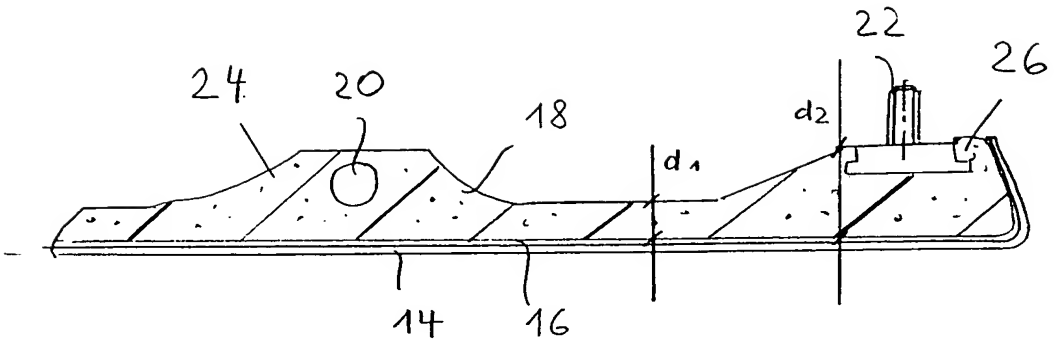
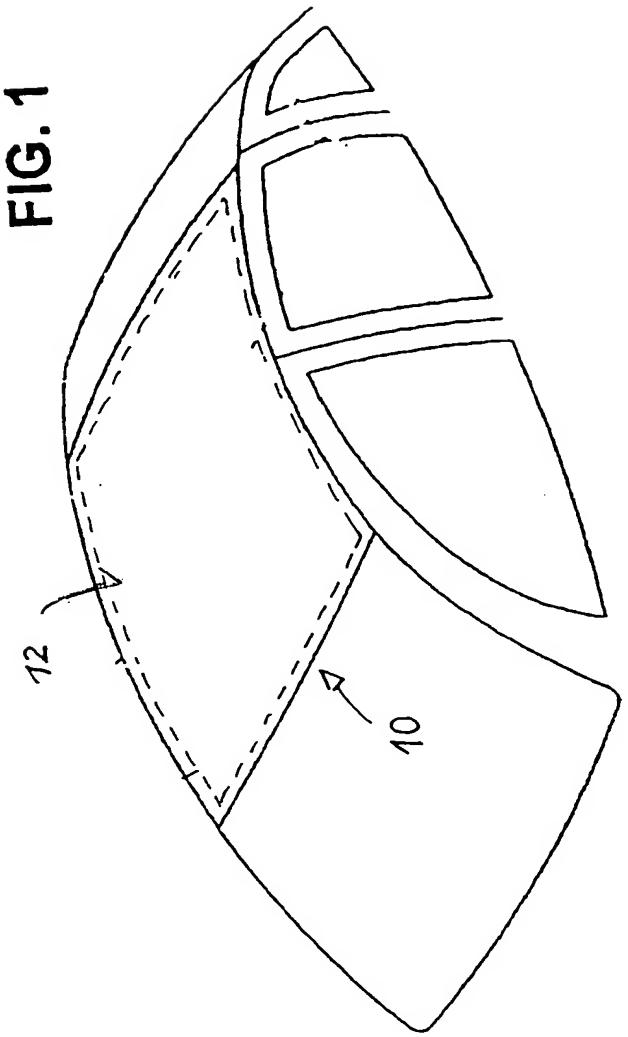

22
26
24
20
18
d_2
d_1
14
16

FIG. 1



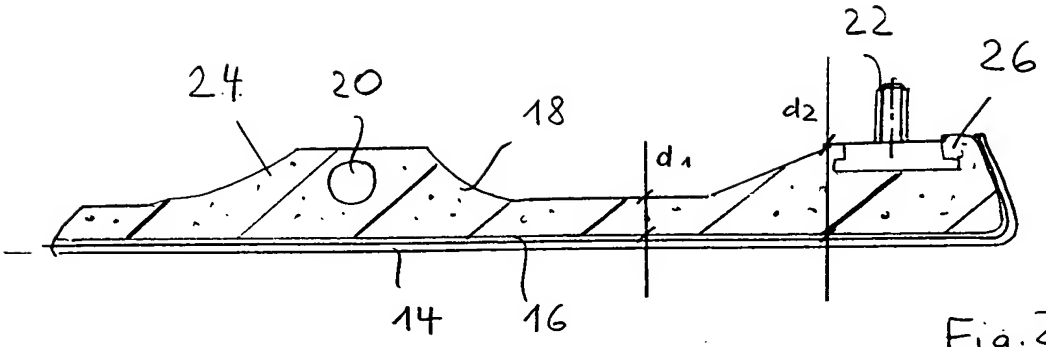


Fig.2

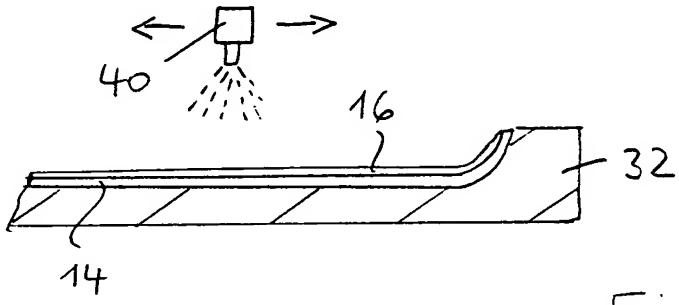


Fig.3

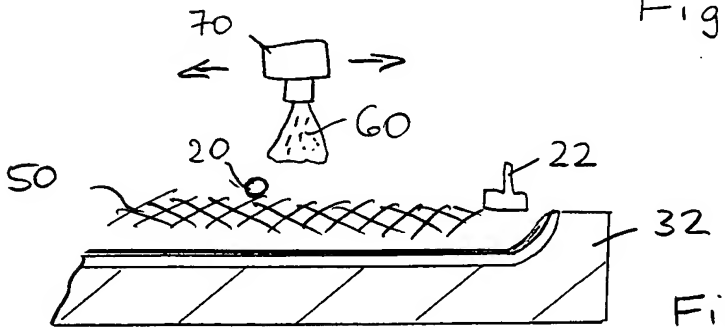


Fig.4

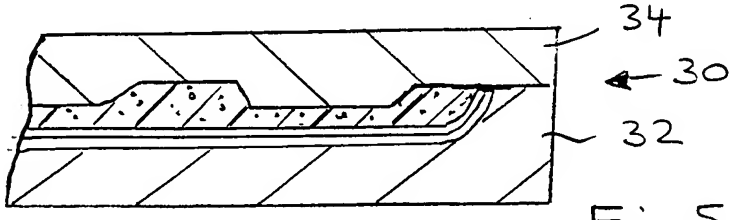


Fig.5